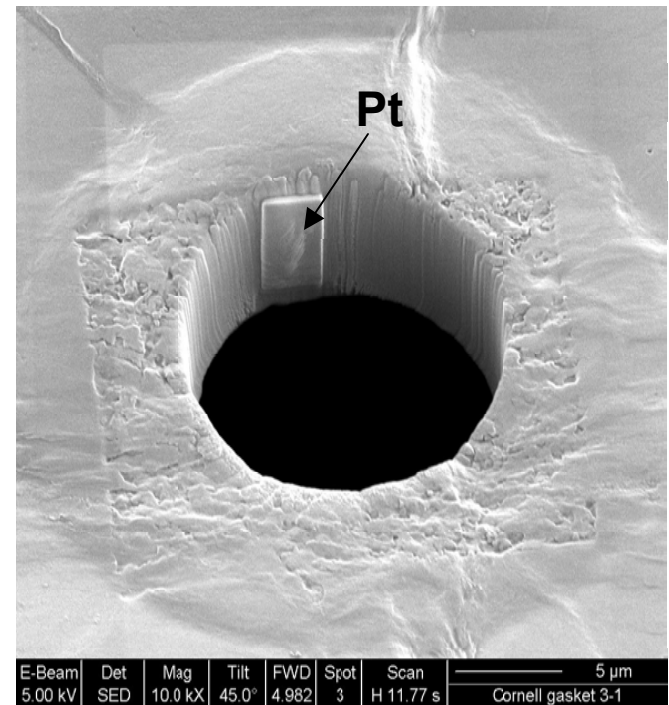


Positional Internal Deposition of Submicron Thick Platinum X-ray Marker for Pressure Measurement

Arthur L. Ruoff, Cornell University, DMR-0304745

The primary static high pressure gauge is the x-ray marker, whose equation of state is obtained by shock experiments. If powders or foil are used, it is difficult to perform good optical experiments. An alternative is to have a very small diameter x-ray beam hit precisely on the gasket at the edge of the sample hole (the gasket now being the marker). This is expensive and difficult to achieve. Using ion beam techniques a thin layer (0.5 nm) of Pt whose equation of state is known to 1 TPa was deposited from a metal-organic on the inside wall of the cylindrical sample hole in a tungsten gasket.

An excellent Pt x-ray pattern was achieved from the precisely (radially) located sample to 301 GPa enabling the calibration of a new optical pressure gauge and the conversion of insulating solid methane to a semiconductor.



Pt deposit (0.5 nm thick) on wall of sample hole

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Education:

In addition to learning new ultrahigh pressure techniques, my Postdoctoral Associate, Liling Sun, learned about making gasket holes for samples by the use of ion beams, a technique invented here earlier. She and the P.I. also learned about using ion beam deposition techniques, which were used for deposition of a very thin x-ray marker materials for pressure measurement at a precise location. This technique was described in a graduate course taught by the P.I.

Societal Impact:

In the present case a submicron layer of platinum (with a thickness of 1/200 of the diameter of a human hair) was deposited on the **INSIDE** wall of a tungsten gasket sample hole thus precisely locating the x-ray marker platinum for pressure measurement in close proximity to the sample. This creates an easy method for measuring ultra pressure (such as at the earth's core) at a precise location. It is likely that internal depositions will also prove useful for the semiconductor chip industry.